Owner's Manual
P/N 82034802Rev.C
Model MT64DSU

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Record of Revisions

Revision	Description
B (6/10/96)	Manual revised. Additional information on the CompuServe/ Internet forums; information on Multi-Tech's Fax-Back Service; documentation of a new DIP-Switch Summary; editorial and format changes throughout this manual.
C (12/15/98)	Manual revised. Reproduced using new Owner's Manual format. Made technical corrections and editing updates. Removed all references to 2-wire connector.

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MultiDSU64K

Chapter 1 - Introduction and Description

MultiTech Systems

Introduction

Welcome to Multi-Tech's new MultiDSU64K a stand-alone integrated Data Service Unit (DSU), model number MT64DSU, for accessing 4-wire switched or dedicated digital links (Figure 1-1). The MultiDSU64K is a compact easy to operate unit with features allowing flexibility in meeting your transmission requirements. The unit operates with 56 Kbps DDS (Digital Data Services) or switched 4-wire networks or compatible digital data services, and 64 Kbps dedicated 4-wire services.

The unit contains V.35 and EIA RS-232C connectors on the back panel to connect a computer or Data Terminal Equipment (DTE) and a RJ-48 Line jack to connect to your DDS or compatible digital data service. The MultiDSU64K supports AT dialing for asynchronous operation and DTR dialing or V.25bis dialing for synchronous operation.

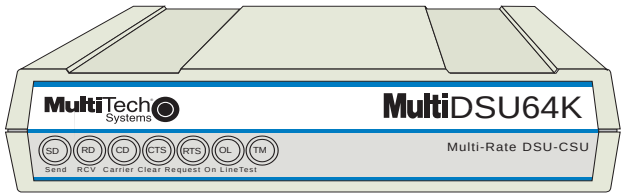


Figure 1-1. MultiDSU64K

About This Manual

This manual describes the MultiDSU64K and explains how to install and cable the unit. The information contained in each chapter is as follows:

Chapter 1 - Introduction and Description

This chapter provides an overview of DSU/CSU basics, information on power, front panel indicators, back panel connectors, and a list of the relevant technical specifications.

Chapter 2 - Installation and Cabling

Chapter 2 provides information on connecting the MultiDSU64K to a computer or DTE device and a DDS network. The chapter provides a detailed description of each of the MultiDSU64K DIP-Switch options with all default settings.

Chapter 3 - Testing Your MultiDSU64K

Chapter 3 dicussess the MultiDSU64K's built-in test features.

Chapter 4 - Service, Warranty, Technical Support & BBS

Chapter 4 provides instructions for getting MultiDSU64Ks serviced at the factory and information on product warranty; information about Multi-Tech's user Bulletin Board Service (*BBS*), receiving technical support via the CompuServe/Internet forums and information on Multi-Tech's Fax-Back Service.

DSU Basic Functions

A DSU (Data Service Unit) and a CSU (Channel Service Unit) are typically connected to provide the interface between DTE (Data Terminal Equipment) and the DDS (Digital Data Service) or other four-wire networks. A DSU converts data to a bipolar format for transmission over the digital line. The CSU terminates the user's digital circuit, does the line conditioning, provides FCC Rules compliance, and handles the CO (Central Office) loopback commands. The MultiDSU64K contains the functions of a Data Service Unit (DSU) and a Channel Service Unit (CSU) in a single package.

DSU Functions

The DSU encodes data as pulses on the communications line by converting the customer data stream to bipolar format for transmission over the digital network.

CSU Functions

The CSU is used to terminate the digital circuit at the customer site. It performs line conditioning functions, ensures network compliance with FCC rules, and responds to test commands (either from the telco central office or from the CSU).

Figure 1-2 shows the MultiDSU64K in a basic DDS network installation.

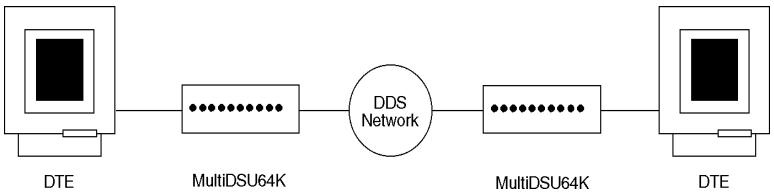


Figure 1-2. Basic DSU/CSU Configuration

Front Panel Indicators

The MultiDSU64K has seven diagnostic LED indicators. They are:

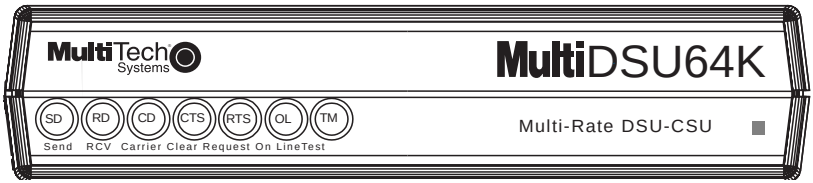


Figure 1-3. LED Indicators

SD — **Transmit (Send) Data:** This LED blinks when data is being transmitted, on for a space, off for a mark.

RD — **Receive Data:** This LED blinks when data is being received, on for a space, off for a mark.

CD — **Carrier Detect:** This LED is lit when a valid signal from the remote DSU is detected. This indicator is off if the DSU receives an idle code. If RTS is off at the remote DSU, then the network sends an idle code to the local DSU.

CTS — **Clear To Send:** The CTS (Clear to Send) LED lights when the MultiDSU64K generates a CTS in response to either an RTS signal received at the DTE connector, or RTS forced on by the corresponding DIP-Switch.

RTS — **Request To Send:** The RTS LED lights when the RTS signal is received from the DTE. The DIP-Switch for RTS Forced On does not affect this indicator. Refer to Chapter 2 for switch settings.

OL — **On Line:** The OL (On Line) LED lights to indicate the MultiDSU64K has detected a signal from the network.

TM — **Test Mode:** The TM LED lights when either Local Loopback (to DTE), Remote Digital Loopback, Digital Loopback (to line) or Test Pattern DIP-Switches are enabled. If the Test Pattern DIP-Switch is enabled, then the TM LED blinks when errors are detected. When the TM LED is lit, network transmit/receive operation cannot occur. Refer to the *"Diagnostic"* Tests section for more information.

Back Panel

The cable connections for the MultiDSU64K are made at the back panel. The input data (DCE interface) is through either an RS-232 or V.35 connection; and, theDDS network connection is through an RJ48S line jack.

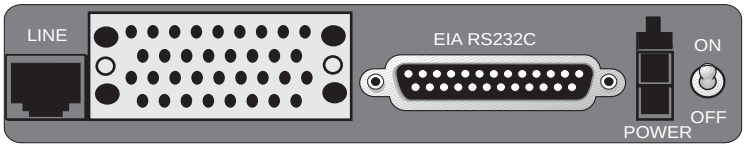


Figure 1-4. Back Panel Connectors

RS-232C Connector

The RS-232C connector is used to connect the MultiDSU64K to a computer or DTE device.

V.35 Connector

The V.35 connector is used to connect the MultiDSU64K to a computer or DTE device.

RJ48S Jack

The RJ48 line interface jack is used to connect the MultiDSU64K to a DDS network.

Multi DSU Loopback Cable

The Multi DSU loopback cable is used to test mux internal composite link DSU or external DSU.

Power Connector

The Power connector is used to connect the external power supply to the unit.

On/Off Switch

The power switch provides DC power to the unit when placed in the ON position and terminates power when placed in the OFF position.

Features

Your Multi-Tech DSU/CSU provides the following features:

- supports direct connection to the DATAPHONE Digital Data Service (DDS) or compatible network;
- selectable sync speeds of 9600, 19200, 56000 for 4-wire lines and 64000 bps for 4-wire dedicated lines;
- selectable async speeds of 9600, 19200, 38400 and 57600 bps;
- Standard RS-232C, V.35 and DDS interfaces provided;
- Automatic rate adaption from DCE data rate to 56 Kbps or 64 Kbps line rate in both sync and async modes; and
- elastic store (for analog off-net extensions).
- multiple selectable clocking

  * External clocking
  * Internal clocking
  * DDS (slave) clocking

- RTS signal forced on selection
- DSR signal forced on selection
- multiple MultiDSU64K-activated diagnostic tests:

  * Local loopback test
  * Digital loopback test
  * Test pattern generator/detector

- multiple Telco-activated diagnostic tests:

  * DSU loopback test
  * CSU loopback test

- Model Number: MT64DSU
- Device Operation: combined DSU and CSU

Technical Specifications

- Interfaces
  RS-232C — DB25S (female)
  V.35 — 34-pos. rectangular (female)
  DDS — RJ48 8-position keyed jack
- Power Requirements — 117V AC, 50-60 Hz, 10 Watts
- Temperature — 0 to 50 degrees C
- Humidity — 95% (non-condensing)
- Dimensions — 1.38" H x 6.15" W x 9" D (3.5 cm x 15.6 cm x 22.9 cm)
- Weight — 2 Lbs. (.9 Kg.) without power transformer 2.7 Lbs. (1.2 Kg.) with power transformer
- Certification — FCC Part 15 Class A FCC Part 68 UL Listed
- Compatibility — AT&T Pubs 62310, 41450 and
- FIC Codes — 04DU5-56 56 Kbps
  Digital Interface — 04DU5-64 64 Kbps
- USOC Jack — RJ48S - 4-wire
- Modulation — bipolar return to zero
- Transmit Level — 1.4V peak (+6dBm) into 135 Ohm
- Output Impedance — 135 ohms
- Receive Levels — +6 to -45 dBm at 64000 bps
- Input Impedance — 135 ohms
- RTS Delay: — .8mSec

MultiDSU64K

Chapter 2 - Installation and Cabling

MultiTech® Systems

Introduction

This chapter provides information for configuring and cabling the MultiDSU64K. It is assumed that the reader is familiar with the function and operation of data communications equipment and is technically qualified to provide installation service.

Unpacking

The shipping box contains the MultiDSU64K, an RJ48S line cord, a DSU Loopback cable, an AC Power Transformer and an Owner's Manual.

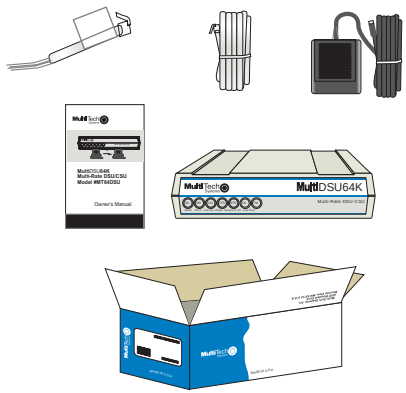


Figure 2-1. Unpacking

Safety Warnings

1. Never install telephone wiring during a lightning storm.
2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. Never touch uninsulated telephone wires or terminals unless the telephone line is disconnected at the network interface.
4. Use caution when installing or modifying telephone lines.
5. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock.
6. Do not use the telephone to report a gas leak near the leak.

Cabling Procedure

Installation of the MultiDSU64K includes making the proper cable connections and turning power on.

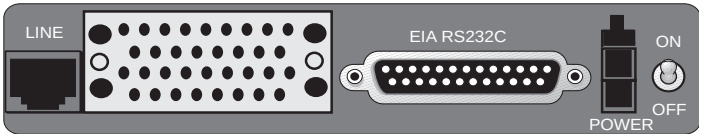


Figure 2-1. MultiDSU64K Back Panel

Perform the following procedure to install your MultiDSU64K.

1. Verify that the Dip-Switches on the MultiDSU64K are set for your particular configuration.
2. Connect the appropriate MultiDSU64K back panel DTE interface connector, depending on the DTE:
   - Connect the RS-232C connector to the 25-pin DB25S receptacle. Use the two screws to secure the connection. Or,
   - connect the 34-position rectangular V.35 connector to the V.35 receptacle.
3. Connect the “LINE” Jack of the MultiDSU64K to the DDS receptacle using the line cord provided.

   Note: any cables connected to the computer must be shielded to reduce interference.
4. Connect the other end of the interface cable to the DTE’s port connector.
5. Plug the Power Cord into the POWER jack on the back panel.
6. Plug the power transformer into an appropriate electrical outlet.

   Note: Use only the power supply supplied with the MultiDSU64K. Use of any other power supply will void the warranty and could damage this device.
7. Turn the POWER switch On. The MultiDSU64K will now operate with the configuration DIP-Switches set to the most typical application.

DIP Switch Settings

The MultiDSU64K printed circuit board contains one 12-position DIP-Switch block and one 4-position DIP-Switch block as shown in Figure 2-2. They are located on the side of the circuit board, and are accessible through the side of the chassis. Each individual switch is numbered, and can be in either an up (OPEN) or down (CLOSED) position.

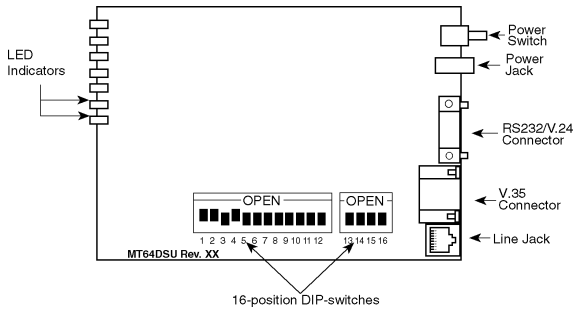


Figure 2-2. MultiDSU64K PC Circuit Board

The MultiDSU64K is shipped from the factory with the configuration DIP-Switches set to the most common settings. The factory default settings are:

- 56 Kbps Data Rate Enabled
- DDS Clocking
- RTS Forced On
- Synchronous Mode On
- Test Pattern Disabled
- Loopback Tests Disabled
- Elastic Store Disabled
- 4-Wire and Dedicated Line Operation Enabled

Switches #1 and #2 Speed Switches (Synchronous Mode)

DIP-Switches #1 and #2 are used to set the synchronous data rate. Switches #1 and #2 are used in combination, to select the desired speed in your application. Note that first the asynchronous/ synchronous option must be chosen via DIP-Switch #5.

9600 bps Operation	= Switch #1 DN and Switch #2 DN
9200 bps Operation	= Switch #1 UP and Switch #2 DN
56000 bps Operation	= Switch #1 DN and Switch #2 UP
64000 bps Operation	= Switch #1 UP and Switch #2 UP
(Factory Default Setting	= Switch #1 DN and Switch #2 UP)

Switches #1 and #2 Speed Switches (Asynchronous Mode)

DIP-Switches #1 and #2 are used to set the asynchronous data rate. Switches #1 and #2 are used in combination, to select the desired speed applications. Note that first the asynchronous/synchronous option must be chosen via DIP-Switch #5.

9600 bps Operation	= Switch #1 DN and Switch #2 DN
19200 bps Operation	= Switch #1 UP and Switch #2 DN
38400 bps Operation	= Switch #1 DN and Switch #2 UP
57600 bps Operation	= Switch #1 UP and Switch #2 UP
(No Factory Default Setting	= User Selectable)

Switches #3 and #4 Internal/External/DDS Clocking *(Asynchronous/Synchronous Mode)*

DIP-Switches #3 and #4 are used in combination to select clocking (timing for synchronization) from one of three sources--Internal, External or DDS Clocking.

Internal clocking enables the MultiDSU64K to accept timing from its internal timing oscillator.

External clocking allows the MultiDSU64K to derive timing from any external device that can supply timing to the External Transmit Clock line on the MultiDSU64K's interface connector. This external clock must be within 0.008% of the nominal data rate.

DDS clocking (default) allows the MultiDSU64K to accept timing signals from the DDS network's receive bipolar signal. Use this selection whenever the MultiDSU64K is connected to the DDS network lines.

Internal Clocking	=	Switch #3 UP and Switch #4 UP
External Clocking	=	Switch #3 UP and Switch #4 DN
DDS Clocking	=	Switch #3 DN and Switch #4 DN
(Factory Default Setting	=	Switch #3 DN and Switch #4 DN)

Switch #5
Asynchronous/Synchronous Operation (Asynchronous/Synchronous Mode)

The MultiDSU64K can operate in either Asynchronous or Synchronous mode. In Synchronous mode, start and stop bits are eliminated; internal clock circuits for receive and transmit timing on the RS-232C or V.35 interface are activated.

Asynchronous Operation	=	Switch #5 UP
Synchronous Operation	=	Switch #5 DOWN
(Factory Default Setting	=	DOWN)

Switch #6
Request To Send Forced - "RTS" (Asynchronous/Synchronous Mode)

With this option enabled, the MultiDSU64K provides a continuous CTS signal, and disregards the state of the RTS signal at the DTE interface. This provides a continuous outbound indication to the network and remote device that there is a "*Carrier on*". For many networks (e.g., point-to-point), it is best to maintain a "*Carrier on*" status on the communications channel to help minimize line turnaround delays. This option is usually enabled for central site DSU installations with multipoint lines (i.e., when continuous outbound "*Carrier on*" is desired). This option must be disabled on the remote station of a multipoint installation. When this option is disabled, the MultiDSU64K receives and uses the RTS signal from the DTE.

RTS functions Normally	=	Switch #6 UP
RTS forced On	=	Switch #6 DOWN
(Factory Default Setting	=	DOWN)

Switch #7
Data Set Ready "DSR"
(Asynchronous/Synchronous Mode)

When this option is enabled, the MultiDSU64K forces the DSR signal on continuously. The continuous DSR signal is used to eliminate momentary link interruptions that may be interpreted by the DTE as a communications channel failure.

DSR controlled by DSU	=	Switch #7 UP
DSR Forced On	=	Switch #7 DOWN
(Factory Default Setting	=	DOWN)

Switch #8
Local Loopback Test (to DTE)

Refer to Diagnostics Tests section in Chapter 4.

Switch #9
Digital Loopback Test (to the Line)

Refer to Diagnostics Tests section in Chapter 4.

Switch #10
Remote Digital Loopback Test

Refer to Diagnostics Tests section in Chapter 4.

Switch #11
Test Pattern

Refer to Diagnostics Tests section in Chapter 4.

Switch #12
Elastic Store
(Asynchronous/Synchronous Mode)

This function allows the MultiDSU64K to compensate for small timing phase *"drifts"* that occur in applications using analog modems for off-net (non-DDS) extensions. An analog off-net extension application is described in Appendix A. This option should be enabled on all MultiDSU64Ks that are connected to analog modems.

Elastic Store Enabled	=	Switch #12 UP
Elastic Store Disabled	=	Switch #12 DOWN
(Factory Default Setting	=	DOWN)

Switch #13

This switch must be in the DOWN position.

Switch #14
Dedicated/Switched Line Operation (Asynchronous/Synchronous Mode)

The MultiDSU64K works over either Dedicated or Switched lines. Note you must have this switch positioned in Switched Line mode (UP) in order to issue AT Commands.

Switched Line	=	Switch #14 UP
Dedicated Line	=	Switch #14 DOWN
(Factory Default Setting	=	DOWN)

Switch #15
DTR Forcing (Asynchronous/Synchronous)

It is advisable to force DTR in order for the terminal to communicate properly with the DSU in Command mode.

DTR Controlled by DTE	=	Switch #15 UP
DTR forced On	=	Switch #15 DOWN
(Factory Default Setting	=	DN)

Switch #16

This switch is not used (reserved for future use).

MultiDSU64K

Chapter 3 - Testing

MultiTech® Systems

Diagnostic Tests

The MultiDSU64K is set to a default of Normal (non-diagnostic) mode at the factory.

When a failure occurs in the digital facility (DDS circuit), the network detects the failure. Your equipment can detect failure by the absence or distortion of the digital signal. If the remote equipment is not transmitting properly, contact your telephone company. If the telco is required to perform remote tests, the channel will be temporarily interrupted and loss of data may occur. The following sections describe the diagnostic tests available for the MultiDSU64K.

DSU Loopback Test

This test lets you verify proper DSU operation by matching a transmitted signal to the *"looped-back"* receive signal. Refer to Appendix B for cable description. Note: The DSU must be in 4-wire dedicated line mode to perform this test.

1. Obtain a DSU Loopback cable (#45640100) from Multi-Tech, or assemble one. Refer to Appendix B for instructions on building the Loopback cable.
2. Plug the Loopback cable into the back panel LINE jack.
3. If you send data from your DTE, it should be "looped back" to your DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the DTE.

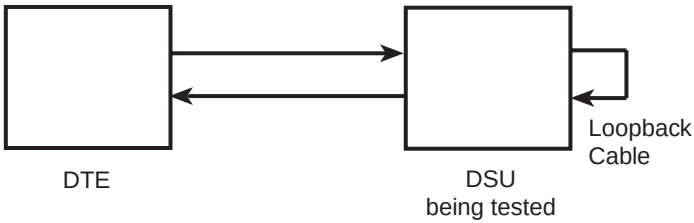


Figure 3-1. DSU Loopback Test with Loopback Cable

Local Loopback Test

This test allows you to test the local DTE and the local MultiDSU64K. Use the following steps to perform the Local Loopback Test.

1. Set DIP-Switch #8 to the UP position.
2. The front panel Test (TM) LED lights, and if you send data from your DTE, it should be “looped back” to your DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the DTE.

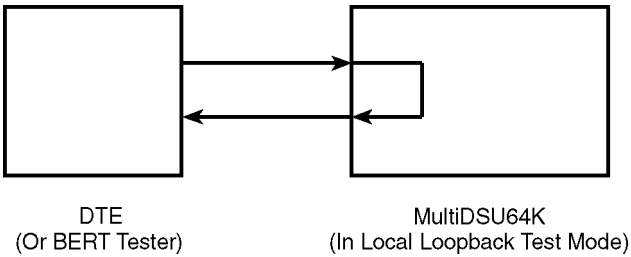


Figure 3-2. Local Loopback Test

Digital Loopback Test

This test allows you to test the local DTE, the local MultiDSU64K, the communications link, and the remote MultiDSU64K. Use the following steps to perform the Digital Loopback Test.

1. Set DIP-Switch #9 on the remote MultiDSU64K to the UP position.
2. The front panel Test (TM) LED lights, and if you send data from the local DTE, it should be looped back to the local DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the local DTE.

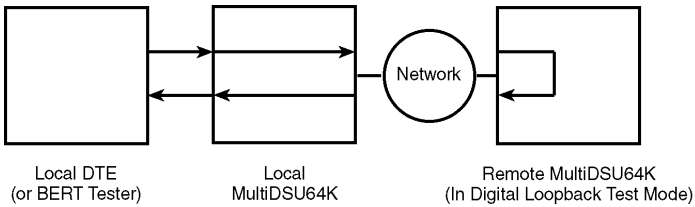


Figure 3-3. Digital Loopback Test

Local Loopback Test With Test Pattern

This test allows you to test the local MultiDSU64K.

Perform the following steps to enable this test:

1. Set DIP-Switch #8 to the UP position.
2. Set DIP-Switch #11 to the UP position.
3. The front panel (TM) LED lights, and if errors are detected, the Carrier Detect LED blinks.

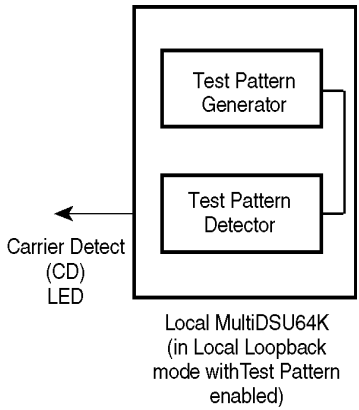

Test Pattern Generator
Test Pattern Detector
Carrier Detect (CD) LED
Local MultiDSU64K (in Local Loopback mode withTest Pattern enabled)

Figure 3-4. Local Loopback Test with Test Pattern

Digital Loopback Test With Test Pattern Test

This test allows you to test the local MultiDSU64K, the communications link, and the remote MultiDSU64K. Use the following steps to perform the Digital Loopback Test with the Pattern Test.

With this test enabled, the MultiDSU64K sends and detects a predefined 511-bit pseudo-random test pattern. When an error is detected by the MultiDSU64K, the CD (Carrier Detect) LED flashes.

1. Set DIP-Switch #9 on the remote MultiDSU64K to the UP position.
2. Set DIP-Switch #10 on the local MultiDSU64K to the DOWN position.
3. The test pattern is generated and either detected as a good test pattern (test patterns match) or as a failed test (test pattern received does not match the pattern sent).

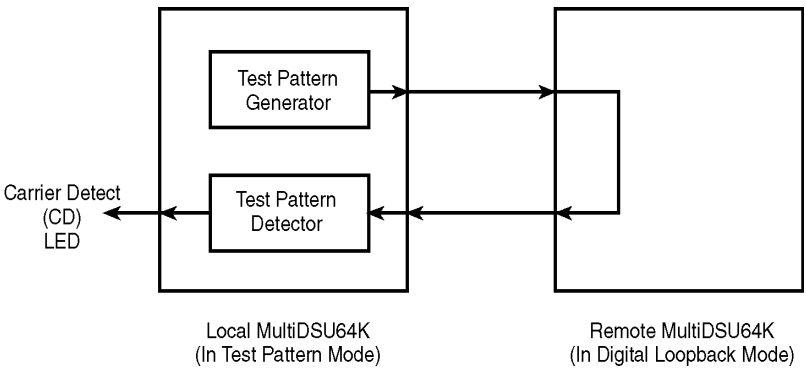

Test Pattern Generator
Test Pattern Detector
Carrier Detect (CD) LED
Local MultiDSU64K (In Test Pattern Mode)
Remote MultiDSU64K (In Digital Loopback Mode)

Figure 3-5. Digital Loopback with Test Pattern Test

Remote Loopback Test

This test allows you to test the local DTE, the local MultiDSU64K, the communications link, and the remote MultiDSU64K. Use the following steps to perform the Remote Loopback Test.

1. Set DIP-Switch #10 on the local MultiDSU64K to the UP position.
2. The front panel Test (TM) LED lights, and if you send data from the local DTE, it should be looped back to the local DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the local DTE.

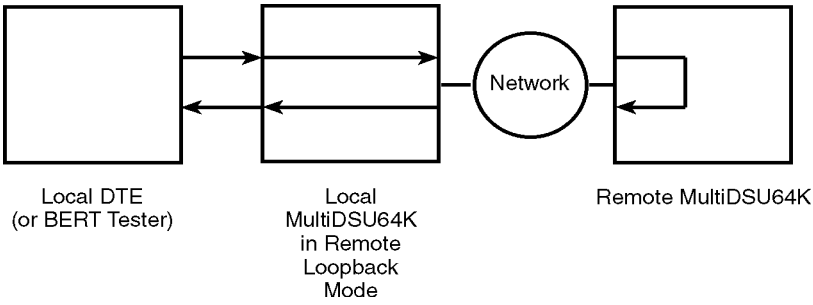


Figure 3-6. Remote Loopback Test

Remote Loopback Test With Test Pattern Test

This test allows you to test the local MultiDSU64K, the communications link, and the remote MultiDSU64K. Use the following steps to perform the Remote Loopback Test with the Pattern Test.

With this test enabled, the MultiDSU64K sends and detects a pre-defined 511-bit pseudo-random test pattern. When an error is detected by the MultiDSU64K, the CD (Carrier Detect) LED flashes.

1. Set DIP-Switch #10 on the local MultiDSU64K to the UP position.
2. Set DIP-Switch #11 on the local MultiDSU64K to the UP position.
3. The test pattern is generated and either detected as a good test pattern (test patterns match) or as a failed test (test pattern received does not match the pattern sent).

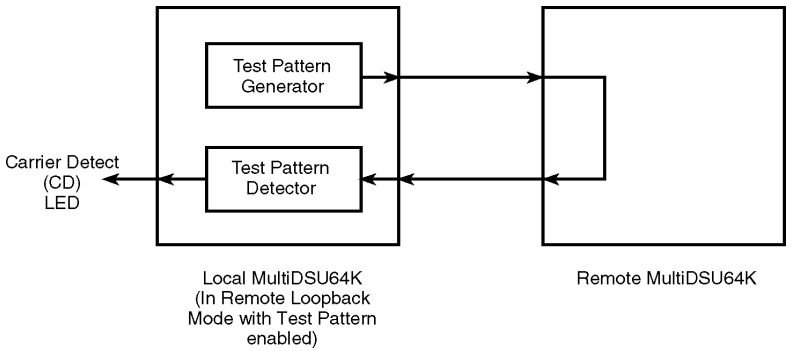

Test Pattern Generator
Test Pattern Detector
Carrier Detect (CD) LED
Local MultiDSU64K (In Remote Loopback Mode with Test Pattern enabled)
Remote MultiDSU64K

Figure 3-7. Remote Loopback with Test Pattern Test

DSU Back-to-Back Test

This test lets you connect two DSUs with a back-to-back cable to verify proper DSU operation. Using a DSU that is known to be operational, you can test a second DSU that is suspect.

1. Obtain a DSU Back-to-Back cable (#45050000) from Multi-Tech, or assemble one. Refer to Appendix B for instructions on building the Back-to-Back cable.
2. Plug the cable into each DSU's LINE jack.
3. On the *"good"* DSU, set DIP switch #9 to the UP position.
4. Set one DSU to internal clocking and the other DSU to DDS clocking.
5. If you send data from your DTE, it should be "looped back" to your DTE. If you have access to a Bit Error Rate Tester, this can be used in place of the DTE.

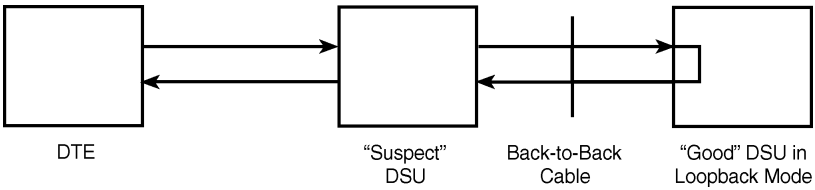


Figure 3-8. Back-to-Back Testing

MultiDSU64K

Chapter 4 - Warranty, Service and Tech Support

MultiTech Systems

Introduction

This chapter starts out with statements about your MultiDSU64K's two-year warranty. The next section, Tech Support, should be read carefully if you have questions or problems with your MultiDSU64K. It includes the technical support telephone numbers, space for recording your MultiDSU64K information, and an explanation of how to send in your MultiDSU64K should you require service. The next three sections explain how to use our Bulletin Board Service (*BBS*) and receive support through CompuServe and the Internet forums. The final section explains how to obtain a catalog of available documents and then order technical literature using our 24-hour Fax-Back Service.

Limited Warranty

Multi-Tech Systems, Inc. (*"MTS"*) warrants that its products will be free from defects in material or workmanship for a period of two years from the date of purchase, or if proof of purchase is not provided, two years from date of shipment. MTS MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by the customer or any party without MTS's written authorization, or used in any manner inconsistent with MTS's instructions.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PURCHASE PRICE FOR DEFECTIVE PRODUCTS.

On-line Warranty Registration

If you would like to register your RouteFinder electronically, you can do so at the following address:

http://www.multitech.com/support/register.htm

Tech Support

Multi-Tech has an excellent staff of technical support personnel available to help you get the most out of your Multi-Tech product. If you have any questions about the operation of this unit, call 1-800-972-2439. Please fill out the MultiDSU64K information (below), and have it available when you call. If your MultiDSU64K requires service, the tech support specialist will guide you on how to send in your MultiDSU64K.

Recording MultiDSU64K Information

Please fill in the following information on your Multi-Tech MultiDSU64K. This will help tech support in answering your questions. (The same information is requested on the Warranty Registration Card.)

Model No.:_____
Serial No.:_____
Firmware Version:_____

The MultiDSU64K model and serial numbers are silkscreened on the bottom of your modem. Type **ATI** for MultiDSU64K firmware version.

Please note the status of your MultiDSU64K before calling tech support. This status can include LED indicators, screen messages, diagnostic test results, problems with a specific application, etc. Use the space below to note MultiDSU64K status:

~Notes~

Service

If your tech support specialist decides that service is required, your MultiDSU64K may be sent (freight prepaid) to our factory. Return shipping charges will be paid by Multi-Tech Systems).

Include the following with your MultiDSU64K:

- a description of the problem.
- return billing and return shipping addresses.
- contact name and phone number.
- check or purchase order number for payment if the MultiDSU64K is out of warranty. (Check with your technical support specialist for standard repair charges.)
- if possible, note the name of the technical support specialist with whom you spoke.

If you need to inquire about the status of the returned product, be prepared to provide the **serial number** of the product sent.

Send MultiDSU64Ks to this address:

MULTI-TECH SYSTEMS, INC.
2205 WOODALE DRIVE
MOUNDS VIEW, MINNESOTA 55112
ATTN: SERVICE OR REPAIRS

The Multi-Tech BBS

For customers who do not have Internet access, Multi-Tech Systems maintains a bulletin board system (BBS) that mirrors its FTP site. Information available from the BBS includes new product information, product upgrade files, and problem-solving tips. The phone number for the Multi-Tech BBS is (800) 392-2432 (USA and Canada) or (612) 785-3702 (international and local).

The BBS can be accessed by any asynchronous modem operating at 1200 bps to 56 Kbps at a setting of 8 bits, no parity, and 1 stop bit (8-N-1).

To log on to the Multi-Tech BBS

1. Set your communications program to **8-N-1**.
2. Dial our BBS at (800) 392-2432 (USA and Canada) or (612) 785-3702 (international and local).
3. At the prompts, type your first name, last name, password; then press ENTER. If you are a first time caller, the BBS asks if your name is spelled correctly. If you answer yes, a questionnaire is displayed. You must complete the questionnaire to use the BBS on your first call.
4. Press ENTER until the Main Menu is displayed. From the Main Menu you have access to two areas: the Files Menu and News. For help on menu commands, type **?**.

To Download a file

If you know the file name

1. From Main Menu, type **F** to access Files Menu, then **D**.
2. Enter name of the file you wish to download from the BBS.
3. If a password is required, enter the password.
4. Answer **Y** or **N** to the automatic logoff question.
5. Select a file transfer protocol by typing the indicated letter, such as **Z** for Zmodem (the recommended protocol).
6. If you select Zmodem, the transfer will begin automatically. If you select another protocol, you may have to initiate the transfer yourself. (In most datacomm programs, the PAGE DOWN key initiates the download.)
7. When the download is complete, press ENTER to return to the File Menu.
8. To exit the BBS, type **G** and press ENTER.

If you don't know the file name

1. From the Main Menu, type **F** to access the Files Menu. For a list of file areas, type **L**, press ENTER, then type **L** and press ENTER again. (If you do not type the second *L*, you will list all of the files on the BBS.)

2. Mark each file area you would like to examine by typing its list number and pressing ENTER.
3. Enter **L** to list all the files in the selected file areas. Enter **C** to go forward in the file list and **P** to go back.
4. To mark one or more files for download, type **M**, press ENTER, type the list numbers of the files, and press ENTER again.
5. Enter **D**. You will see a list of the files you have marked. Enter **E** if you would like to edit the list; otherwise enter **D** again to start the download process.
6. Select a file transfer protocol by typing the indicated letter, such as **Z** for Zmodem (the recommended protocol).
7. If you select Zmodem, the file will transfer automatically. If you select another protocol, you may have to initiate the transfer yourself. (In most data communications programs, the PAGE DOWN key initiates the download.)
8. When completed, press ENTER to return to the File Menu.
9. To exit the BBS, type **G** and press ENTER.

About CompuServe

In addition to the BBS, Multi-Tech provides support through CompuServe's Modem Vendor Forum (*GOMODEMVEN*). Refer to your CompuServe documentation for special operating procedures.

About the Internet

AIf you prefer to receive technical support via the Internet, you can contact Tech Support via e-mail at the following address:

http:\\www.multitech.com_forms\email_tech_support.htm

Multi-Tech's presence includes a Web site at:

http://www.multitech.com

and an ftp site at:

ftp://ftp.multitech.com

About the Multi-Tech Fax-Back Service

Multi-Tech's fax-back system provides 24-hour access to sales, marketing, and technical literature. Dial 612-717-5888, follow the voice prompts, and request document number 10 for a catalog of available documents.

For convenience, have your fax number ready: _____. From the catalog of available documents, you can order newsletters, white papers, press releases, etc. from the sales and marketing index (pages 1-4), or order basic modem operation and troubleshooting guides from the technical support and engineering index. Just enter the applicable FB Doc. # from the left column of the catalog.

MultiDSU64K

Appendixes

MultiTech® Systems

Appendix A - AT Commands and S-Registers

Introduction

AT commands are the means by which you, and your datacomm software, are able to communicate with and configure your MultiDSU64K. They enable you to establish, read, and modify parameters in addition to dialing.

Certain configuration parameters are stored in S-Registers. These Registers may be read, may be written to directly or may be modified by other AT Commands.

V.25bis commands provide an alternate set of commands and responses for applications in which the DTE is synchronous. V.25bis commands do not include any configuration commands; you can, however, execute AT/S-Register commands to configure V.25bis mode operation.

The following sections describe which AT Commands, S-Registers and V.25bis commands are active in configuring and operating your MultiDSU64K.

AT Commands

A wide variety of autodial operations and options can be controlled when the MultiDSU64K is in Command Mode (Switch 14 UP). Remember, nearly all commands have an ***AT*** prefix. These commands are organized into several functional groups. Options shown in **boldface** represent factory defaults.

Configuration Commands

E0 No Command Echo
E1 Enable Command Echo

Q0 Enable Result Codes
Q1 No Result Codes

V0 Terse Result Codes
V1 Verbose Result Codes

Action Commands

A/ Re-execute previous command (no AT prefix required with this command).

DS*n* Dial a stored number (*n = 0 thru 9 memory location*). Ten phone numbers can be stored.

D*xxx* Number of characters allowed in a telephone number string. A telephone number *xxx* may contain a maximum of 16 characters. Note digital circuits do not provide the option of either pulse or tone dialing. The MultiDSU64K, however, will accept either ATDT or ATDP dialing prefix.

H0 Hang-up (go on-hook)

H1 Go on-line (off-hook)

I ID information

&F Load factory default settings

&Z*n = ddd* Store a telephone number *ddd* in phone number memory *n* (*n* has ten locations of memory 0 thru 9).

&Z*?* Display all telephone numbers.

&Z*n*? Display stored phone number (*n* = memory location 0 thru 9).

*R Reset the MultiDSU64K

*W Download parameters to remote unit. All S-Registers S0 through S16; as well as the settings of DIP-Switches 1, 2, 5 thru 7 and 12 can be loaded to the remote unit with this command (S-Registers are described in this subsection).

$ Display HELP information on-screen.

S-Registers

Certain configurations are stored in memory registers called, S-Registers. The ***S*** command is used to assign a value to, and to read the current value of an S-Register. To assign a value to an S-Register, enter the letter ***S***, followed by the S-Register number and an equals sign (=). To read an S-Register value, enter the letter ***S*** followed by the S-Register number and a question mark (*?*), then hit RETURN (e.g., ***ATS8?<CR>***). You should receive a response of the assigned value given to that S-Register. Options shown in **boldface** represent the factory default settings.

S0 Auto-Answer

S0 = 0 Auto-Answer Disabled
S0 = 1 Auto-Answer Enabled
S0 = 2 Auto-Answer under DTR control

S1 Number of Redials

S1 = **0** through 99 (user selectable)

S2 Sync DTE Dialing

S2 = 0 Sync DTE Dialing Disabled
S2 = 1 Dial on DTR transition from low-to-high
S2 = 2 V.25bis sync dialing enabled
S2 = 3 V.25bis or DTR

S3 Auto-Disconnect

S3 = 0 Disconnect when DTR drops
S3 = 1 Disconnect after 10 minutes of data inactivity
S3 = 2 Disconnect after 30 minutes of data inactivity
S3 = 3 Disconnect after 60 minutes of data inactivity
S3 = 4 Disconnect when DTR drops or after 0 minutes of data inactivity
S3 = 5 Disconnect when DTR drops or after 30 minutes of data inactivity
S3 = 6 Disconnect when DTR drops or after 60 minutes of data inactivity
S3 = 7 Auto-Disconnect Disabled

S4 DCE Interface Mode

S4 = 0 **DCE Interface is Async**
S4 = 1 DCE Interface is Sync

S5 (Not Used)

S6 (Not Used)

S7 Echo Canceler Tone

S7 = 0 **Echo Canceler Tone Disabled**
S7 = 1 Echo Canceler Tone Enabled

S8 RTS Control

S8 = 0 **RTS On**
S8 = 1 CTS follows RTS

S9 DSR Control

S9 = 0 **DSR On**
S9 = 1 DSR off in Test Mode or when Off-line

S10(Not Used)

S11(Not Used)

S12 Async data bits excluding start/stop/parity bits

S12 = 0 **8 bits**
S12 = 1 7 bits

S13 Async Stop bits

S13 = 0 **1 bit**
S13 = 1 1.5 bits
S13 = 2 2 bits

S14 Async Parity

S14 = 0 **None**
S14 = 1 Even
S14 = 2 Odd

S15 Async DTE Dialing

S15 = 0 Disabled
S15 = 1 DTR low-to-high Transition
S15 = 2 AT Command
S15 = 3 DTR or AT Command

S16 V.25bis Auto-Dialing Format

S16 = 0 Bit-oriented
S16 = 1 Byte-oriented

S17(Not Used)

S18(Not Used)

S19 Parameter Lock

Parameter lock prevents download from remote unit

S19 = 0 Off
S19 = 1 On

Result Codes

When the MultiDSU64K receives an AT command from the terminal or PC, the MultiDSU64K tries to execute the command, then sends a status message to the PC or terminal which reports the *"results"* of the command (hence the name *"result codes"*). The MultiDSU64K provides you with several responses, or *"Result Codes"*, that provide visual responses during Command mode operation. These Result Codes, when activated by an AT command are displayed on your video monitor. ***ATQ0*** enables Result Code display; and entering ***ATQ1*** disables Result Code display.

You can choose to have these Result Codes displayed in either *"verbose"* (full words) or *"terse"* (digits) format. This is controlled by the ***ATV0*** (terse) or ***ATV1*** (verbose) commands. The MultiDSU64K defaults to verbose format.

MultiDSU64K Result Codes

TERSE	VERBOSE
0	OK
1	CONNECT
2	RING
3	NO CARRIER
4	ERROR
5	NO ANSWER
6	NO DIALTONE
7	REDIAL
8	DIAL IN PROGRESS
9	DOWNLOAD SUCCESS
10	DOWNLOAD FAILURE
11	REMOTE CONFIGURATION LOCKED

Configuration Options

This section describes the configuration parameters option settings. Corresponding S-Registers and AT commands are listed for each option or function.

Synchronous Options

If the MultiDSU64K is configured for synchronous operation (*S4=1), the following options apply:

DTE Dialing (S2) - Selects the option for dialing synchronously. The options are V.25bis, DTR, V.25bis or DTR and DISABLED. When V.25bis is selected, the unit auto-dials in accordance with V.25bis commands. When DTR is selected, the unit dials a stored number in the memory location of 0 whenever DTR goes from low-to-high. If the combination option of V.25bis or DTR is selected, then the unit responds to either V.25bis commands or DTR going high. The DISABLED option prevents any auto-dialing. The factory default setting is V.25bis-- **S2 = 2**.

V.25bis Auto-Dial (S16) - The V.25bis data format may be either bit-oriented (HDLC-like) or byte-oriented (character) depending on the protocol requirements of the DTE. The factory default setting is Bit-oriented-- **S16 = 0**.

Note: that upon power-up the MultiDSU64K responds to default DIP-Switch settings.

Asynchronous Options

If the MultiDSU64K is configured for asynchronous data (S4=0), the following options apply:

Data Bits (S12) - Sets the MultiDSU64K data character format for either 7 or 8 data bits. Data bits do not include start, stop or parity bits. The factory default setting is for 8 bits--**S12 = 0**.

Stop Bits (S13) - Sets the MultiDSU64K data character for 1, 1.5 or 2 stop bits. The factory default setting is 1-- **S13 = 0**.

Parity (S14) - Sets the MultiDSU64K data character format to use NONE, EVEN or, ODD parity. The factory default setting is NONE-- **S14 = 0**.

DTE Dialing (S15) - Selects the type of asynchronous auto-dialing to be used by the DTE port. Options are AT Command, DTR (low-to-high), AT or DTR, and DISABLED. The factory default setting is AT Command--**S15 = 2**.

Parameter Options

The following options enable downloading of configurations parameters to a remote unit and the ability to lock a local unit to prevent local or remote changes to the configuration:

Param Download (*W) - The **AT*W** command downloads parameters to the remote unit. All S-Registers S0 through S16; as well as the settings of DIP-Switches 1, 2, 5 thru 7 and 12 can be loaded to the remote unit.

Param Lock (S19) - Setting this option ON prevents unintentional local changes in parameter settings. When the setting is ON, no parameter, except this one, can be changed from the DCE port and the unit will not accept a download command from the remote unit. The factory default setting is OFF-- **S19 = 0**.

System Reset (*R) - This command performs a *"soft*" reset of the unit and starts the operation from the beginning. It also signals the remote unit (if connected) to clear all remote test conditions.

Default Settings (&F) - This command restores the factory default settings. All factory settings, except stored phone numbers.

Synchronous Auto-Dial

The beginning of this chapter described the AT command set which enables the MultiDSU64K to dial, hang-up, and be configured for various applications. These commands, however, are only functional when the DCE transmits asynchronous data. That is, the AT command set cannot be used in synchronous environments.

CCITT V.25bis commands provide you with an alternate set of commands and responses for synchronous applications. V.25bis commands support dialing functions in synchronous mode according to the recommendations of the CCITT (Consultative Committee of International Telephony and Telegraphy); if you need to establish a datacomm link over a Switched Telephone Network, and your equipment outputs a synchronous data stream, V.25bis commands are essential.

This section includes a description of the command format and a list of V.25bis commands and responses.

List of Commands

Dial Phone Number Provided (CRN) Command

The ***CRN*** command permits the dialing of a phone number (from the command line). It is similar to the ***D*** command of the AT command set. To dial a phone number, enter ***CRNdd...dd*** where ***dd...dd*** is the phone number, which can be up to 16 characters long using any character on the telephone pad.

Store a Phone Number in Memory (PRN) Command

Your MultiDSU64K uses mnemonics for storing phone numbers which you may dial by using the ***CRS*** command. The MultiDSU64K memory holds up to 10 numbers, 16 characters per number. You can store phone numbers in this memory with the ***PRN*** command. The format for this command is ***PRNnn;dd...dd*** where ***nn*** is the memory location for the stored number (any location 0 through 9) followed by a semicolon(***;***) and then ***dd...dd*** (the stored number). The number can include punctuation as required. To clear a number from the V.25bis memory, see the ***CLA*** command.

Clear Number in Memory (CLA) Command

The ***CLA*** command clears a specific number in the ***nn*** phone number memory location by entering **CLA*nn***.

Dial Phone Number Stored in Memory (CRS) Command

A telephone number that is stored in the DSU's memory may be automatically dialed. There are ten locations, 0 through 9. For example, a number stored in ***nn*** location 8 would be entered by dialing ***CRS8*** and hitting RETURN.

Listing Numbers Stored in Memory (RLN) Command

Telephone numbers that you have stored in the DSU's V.25bis memory may be listed and displayed with the ***RLN*** command. It will display all ten ***nn*** storage location numbers and associated telephone numbers with any command letters and punctuation imbedded in each number. The ***RLN*** command is similar to the ***&Z?*** command of the AT command set. To list the V.25bis stored telephone numbers, enter ***RLN*** and hit RETURN.

Disregard or Connect to Incoming Calls (DIC or CIC) Command

The Disregard or Connect to Incoming Calls commands are used for Auto-Answer operations. Your DSU will wait some amount of time or number of rings before answering the call. During that time, you can stop the DSU from answering the call by entering the ***DIC*** (Disregard Incoming Calls) command. The ***CIC*** (Connect to Incoming Calls) command causes your DSU to answer the call (either reversing the effect of a DIC command or simply have your DSU answer the call immediately without waiting the regulation time before answering).

V.25bis Result Codes

V.25bis Responses (Result Codes)

When in V.25bis mode, your MultiDSU64K provides you with several responses which can help you follow the progress of V.25bis operations. These are similar to the Result Codes associated with AT Command mode operation. The V.25bis responses are in the form of three-character mnemonics as listed below:

INC	Incoming Call (same as RING indicator)
VAL	A valid V.25bis command has been attempted (same as OK)
CNX	Call connected
DLC*t*	Call delayed for *t* minutes (number on Delayed list)
CFI*rr*	Call failure indicator where *rr* equals:
et -	Engaged tone (same as BUSY)
nt -	Call Answered but No Answer Tone
rt -	Ring Tone (the remote end is ring but call is aborted after 30-second timeout)
ab -	Call Not Answered
fc -	Number on Forbidden List
ns -	Number not stored in memory
ua -	User Abort
nd -	No Dialtone
cu -	Unknown Command
ff -	Forbidden List full
ms -	Message Syntax Error
ps -	Parameter Syntax Error
pv -	Parameter Value Error
LSN*nn;dd...dd*	Phone number in V.25bis memory
LSD*nn;dd...dd*	Phone number on the Delay list
LSF*nn;dd...dd*	Phone number on the forbidden list
CON *ssss*	Connection at ssss speed (if X1 in effect)

Appendix B - Application Examples

INTRODUCTION

This section illustrates several types of applications in which the MultiDSU64K is typically used. These types include:

- DDS point-to-point application,
- DDS multipoint (polled) application,
- Local Area Data Set,
- External Clocking application, and
- Analog Off-Net Extension application

DDS POINT-TO-POINT APPLICATION

In this application, the MultiDSU64K provides the interface between the DDS line and the DTE at your site. Your network provider will provide (at your request) a DDS line connecting the desired locations. The figure below depicts a sample DDS Point-to-point application.

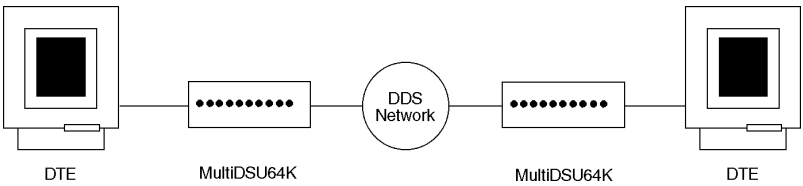


Figure B-1. DDS Point-to-Point Application

DDS MULTIPOINT (POLLED) APPLICATION

Since your Central Office (CO) equipment must include “Multipoint Junction Units” (MJUs) and other special arrangements for this type of service, you may need to coordinate efforts with your network service provider.

The MultiDSU64K at the host end is the Master Station (also called the “Control Station”), which typically has RTS forced on. The attached MultiDSU64Ks are called “Remote Stations” and have RTS controlled by the DTE.

Multipoint DDS provides communication between a control station and two or more remote stations. All data transmitted by the control station is sent to each remote station. For data transmitted from the remote stations, the MJUs combine bit streams from the remote stations into a single, serial bit stream sent to the control station. All stations on the same multipoint circuit must run at the same bit rate (any of the DDS customer service rates).

The figure below shows a typical Multipoint (Polled) application.

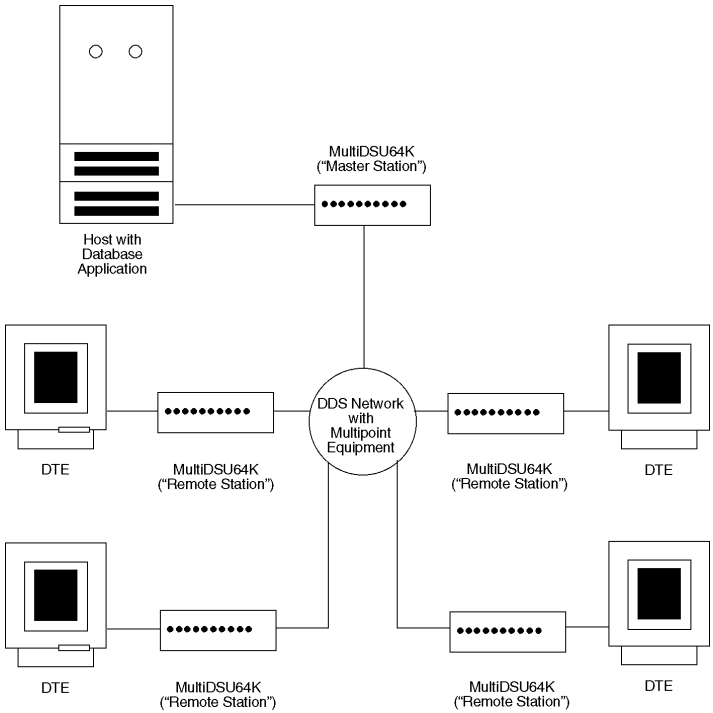


Figure B-2. DDS Multipoint Polled Application

LOCAL AREA DATA SET APPLICATION

Your MultiDSU64K can be used as a point-to-point LADS (Local Area Data Set) at transmission speeds of 2400, 4800, 9600, 19200, 56000 or 64000 bps over 4-wire, non-loaded metallic wire pairs. The installation of the MultiDSU64K in a LADS application is the same as for DDS applications, except for the timing (Clocking) setting. LADS applications require one MultiDSU64K to be set for Internal timing and the other MultiDSU64K to be set for DDS timing (refer to Chapter 2 of this manual). The network cable connection requires *"cross-over"* wiring; the transmit pair of each MultiDSU64K must be connected to the receive pair of the far-end MultiDSU64K.

The MultiDSU64K uses 4-wire non-loaded metallic circuits for LADS applications. The table below outlines approximations for the maximum cable length for limited distance applications.

Data Rate	Wire Gage				
	19 AWG	22 AWG	24 AWG	26 AWG	
56000 bps	10.0	6.0	4.2	3.0	miles
64000 bps	7.8	4.7	3.3	2.3	miles

The figure below depicts a typical Local Area Data Set application.

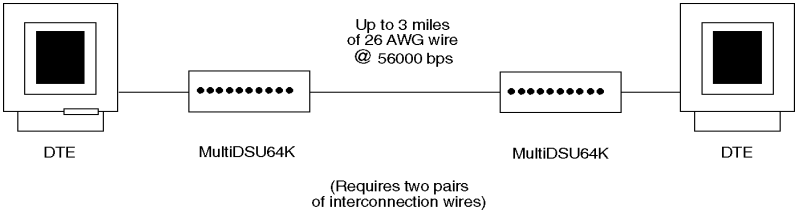


Figure B-3. Local Area Data Set Application

EXTERNAL CLOCKING APPLICATION

This application is similar to the Local Area Data Set application except for the timing option setting. In the example below, the DTE connector of the T1 mux is connected to the DTE connector of the MultiDSU64K. Here, the MultiDSU64K must receive timing information from the T1 mux. The MultiDSU64K is set for external timing in this type of application. At the DTE end, DDS timing is selected, providing normal clocking to the DTE.

The figure below shows a typical External Clocking application.

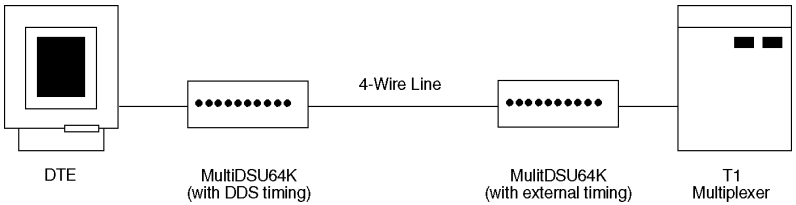


Figure B-4. External Clocking Application

ANALOG OFF-NET EXTENSION APPLICATION

In this application, the MultiDSU64K is used with conventional analog modems and lines to complete DDS circuits in an area where DDS is not available, or where the customer requires an extension of the DDS circuit for a special application.

In applications using the MultiDSU64K for an off-net extension, one MultiDSU64K may be set for External Timing and the other set for DDS Timing; however, in this application, the clock (timing) being supplied must be accurate to +/-0.008% of the enabled data transmission rate.

The Elastic Store option is used in off-net extension applications with analog modems to compensate for small timing phase drifts that typically occur in such applications. A *"cross-over"* cable is required to connect the MultiDSU64K DCE connector to the analog modem in this application (see Appendix C).

The analog modem at the same end as the MultiDSU64K must have External Timing enabled; the modem at the end of the off-net extension must have DDS Timing enabled.

In MultiDSU64K applications that use controlled carrier, the CTS delay for the analog modem at the end of the off-net extension must be longer than the CTS delay of the MultiDSU64K.

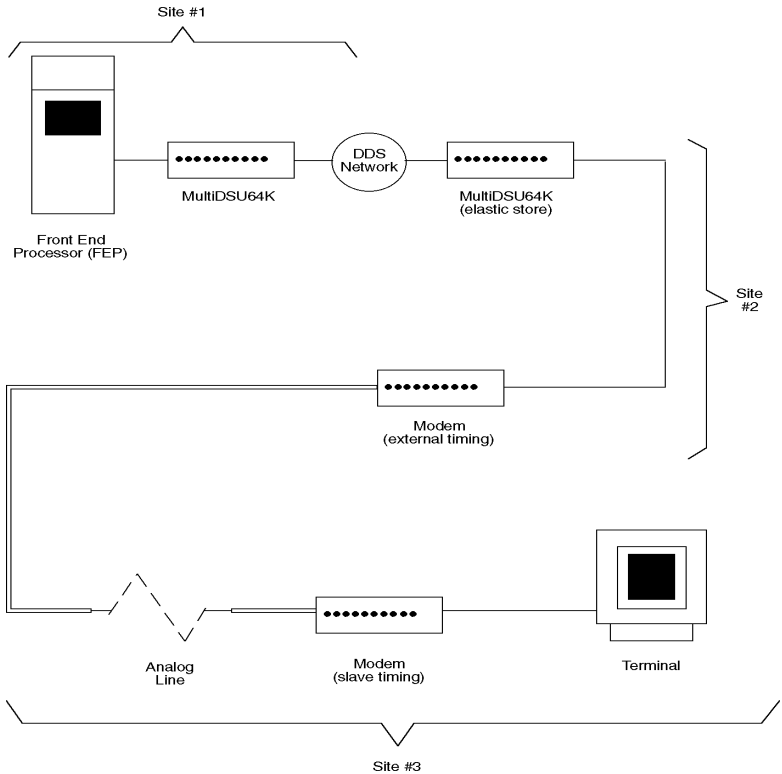


Figure B-5. Analog Off-Net Extension Application

Appendix C - Interface Signals and Connector Pinouts

DDS RJ48S CONNECTOR

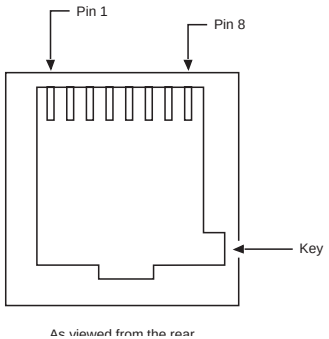


Figure C-1. RJ48S Connection

DESCRIPTION

This connector ties the MultiDSU64K to the DDS Network.

PIN IDENTIFICATION

Pin	Description	Destination
1	N/C	N/C
2	N/C	N/C
3	N/C	
4	Transmit	To Line
5	Receive	From Line
6	N/C	
7	N/C	N/C
8	N/C	N/C

RS-232C DB25S CONNECTOR

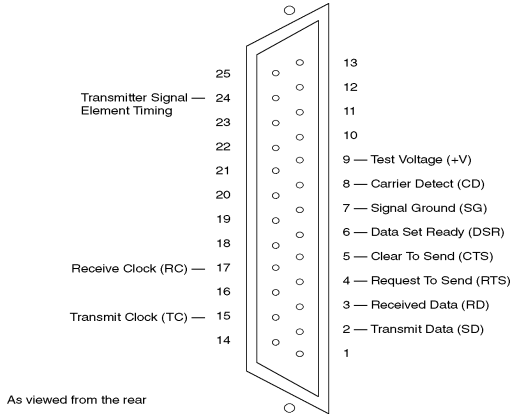


Figure C-2. RS-232 Connection

DESCRIPTION

This connector ties the MultiDSU64K to the DTE. The DB25S connector has the following pinout configuration.

PIN IDENTIFICATION

Pin	Description	Circuit	Source	Function
2	Transmit Data	SD	DTE	Transmitted Data
3	Received Data	RD	DCE	Received Data
4	Request to Send	RTS	DTE	Request to Send
5	Clear To Send	CTS	DCE	Clear to Send
6	Data Set Ready	DSR	DCE	Data Set Ready
7	Signal Ground	SG	--	Signal Ground
8	Carrier Detect	CD	DCE	Carrier Detect
9	Test Voltage	+V	DCE	Test Voltage
15	Transmit Clock	TC	DCE	Transmit Clock
17	Receive Clock	RC	DCE	Receive Clock
24	Transmitter Timing Transmit Clock	XTC	DTE	External

V.35 34-PIN CONNECTOR

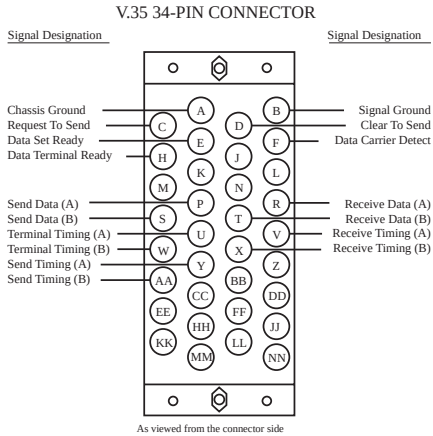


Figure C-3. V.35 Connection

DESCRIPTION

This connector ties the MultiDSU64K to the DTE. The V.35 connector has the following pinout configuration.

PIN IDENTIFICATION

Pin	Description	Pin	Description
A	Chassis Ground	R	Received Data (A)
B	Signal Ground	T	Received Data (B)
C	Request To Send	Y	Transmit Clock (A)
D	Clear To Send	AA	Reansmit Clock (B)
E	Data Set Ready	V	Receive Clock (A)
F	Rec. Line Signal Detect	X	Receive Clock (B)
H	Data Terminal Ready	U	External Transmit Clock (A)
P	Transmitted Data (A)	W	External Transmit Clock (B)
S	Transmitted Data (B)		

LOOPBACK CABLE

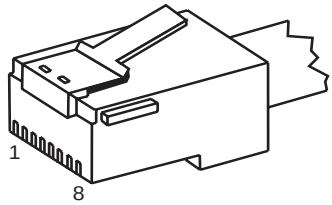
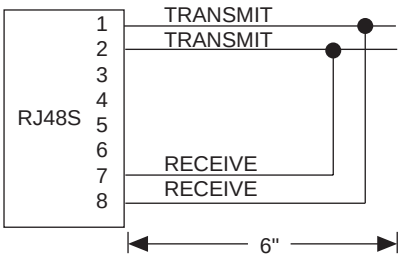


Figure C-4. Loopback Cable

DESCRIPTION

This cable lets you test the MultiDSU64K when a second DSU is not available. It tests the DSU by having the DSU generate a signal, then the cable *"loops"* the signal back to the DSU for comparison to the original signal sent. You can order this cable (#45640100) from Multi-Tech, or build one using the instructions below.

SCHEMATIC



BUILD INSTRUCTIONS

1. Strip cable insulation 3/4"
2. Cut wires 3, 4, 5, 6 off.
3. Strip wires 1, 2, 7, 8 1/4"
4. Solder wires 1 and 8 together.
5. Solder wires 2 and 7 together.
6. Cover solder connections with 1" of shrink tube.

BACK-TO-BACK CABLE

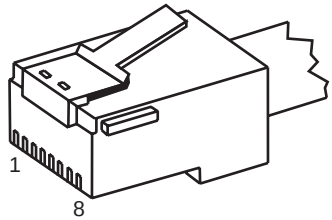
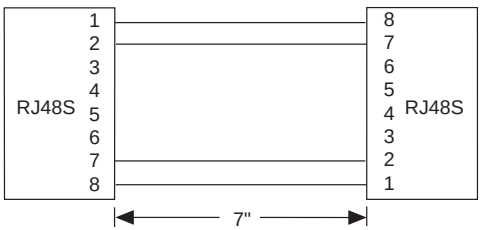


Figure C-5. Back-to-Back Cable

DESCRIPTION

This cable lets you test a suspect DSU by connecting it to a known good DSU. It tests the suspect DSU by connecting its Transmit signal to the good DSUs Receive circuits. You can order it from Multi-Tech (#45050000), or build one using the instructions below. Refer to Chapter 4 for test procedures.

SCHEMATIC



BUILD INSTRUCTIONS

1. Strip cable installation 3/4".
2. Strip wires 1,2,7 and 8 on one end of cable and 8,7,2 and 1 on other end 1/4".
3. Cut unstripped wires off.
4. Solder wire 1 on one connector to 8 on the other.
5. Solder wire 2 on one connector to 7 on the other.
6. Solder wire 7 on one connector to 2 on the other.
7. Solder wire 8 on one connector to 1 on the other.
8. Cover solder connections with 1" of shrink tube.

CROSSOVER CABLE

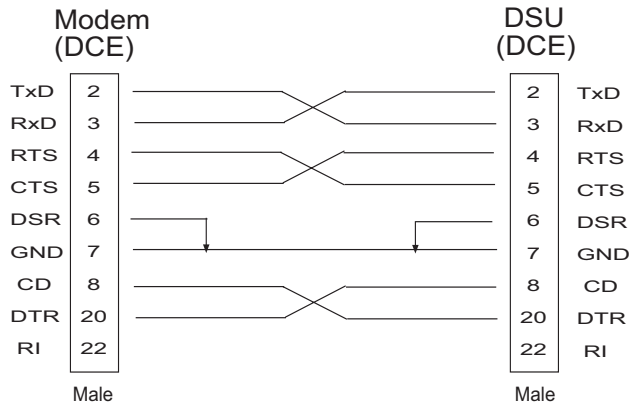


Figure C-6. Crossover Cable

In applcations using the MULTIDSU64K for an off-net extension a *"cross-over"* cable is required to connect the MultiDSU64K DCE connector to the analog modem in this application.

Appendix D - DIP-Switch Summary

Synchronous

DIP-Switch	***Effect***			
	Sync Speeds			
	9.6K	19.2K	56K	64K
#1	DN	UP	*DN	UP
#2	DN	DN	*UP	UP
	Internal	External	DDS	
#3	UP	UP	*DN	
#4	UP	DN	*DN	
#5	UP	Asynchronous Mode On		
	*DN	Synchronous Mode On		
#6	UP	RTS Controlled by DTE		
	*DN	RTS Forced On		
#7	UP	DSR Controlled by DSU		
	*DN	DSR Forced On		
#8	UP	Local Loopback (to DTE)		
	*DN	Normal		

Asynchronous

DIP-Switch	***Effect***			
	Sync Speeds			
	9.6K	19.2K	38.4K	57.6K
#1	DN	UP	*DN	UP
#2	DN	DN	UP	UP
#9	UP	Digital Loopback (to Line)		
	*DN	Normal		
#10	UP	Remote Loopback		
	*DN	Normal		
#11	UP	Test Pattern Enabled		
	*DN	Normal		
#12	UP	Elastic Store Enabled		
	*DN	Elastic Store Disabled		
#13	UP	This switch must be DOWN.		
	*DN			
#14	UP	Switched Line		
	*DN	Dedicated Line		
#15	UP	DTR Controlled by DTE		
	*DN	DTR Forced On		

*Factory Default Setting

Appendix E - FCC Regulations for Telephone Line Interconnection

1. This equipment complies with Part 68 of the Federal Communications Commission (FCC) rules. On the outside surface of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN). If requested, this information must be provided to the telephone company.
2. As indicated below, the suitable jack (Universal Service Order Code connecting arrangement) for this equipment is shown. If applicable, the facility interface codes (FIC) and service order codes (SOC) are shown. An FCC-compliant telephone cord and modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant. See installation instructions for details.
3. The ringer equivalence number (REN) is used to determine the quantity of devices which may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the RENs should not exceed five (5.0).

   To be certain of the number of devices that may be connected to the line, as determined by the total RENs, contact the telephone company to determine the maximum REN for the calling area.
4. If this equipment causes harm to the telephone network, the telephone company will notify you in advance. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.
5. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications in order to maintain uninterrupted service.

6. If trouble is experienced with this equipment (see model indicated below) please contact Multi-Tech Systems, Inc. at the address shown below for details on how to have repairs made. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is resolved.
7. No repairs are to be made by you. Repairs are to be made only by Multi-Tech Systems or its licensees. Unauthorized repairs void registration and warranty.
8. This equipment cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. (Contact the state public utility commission, public service commission or corporation commission for information.)
9. If so required, this equipment is hearing-aid compatible.

Manufacturer:	Multi-Tech Systems, Inc.
Trade Name:	MultiDSU64K
Model Number	MT64DSU
FCC Registration #:	AU7USA-18883-DE-N
Ringer Equivalence:	N/A
SOC Codes:	6.0N
Modular Jack	RJ48S for 4-wire connection

Service Center in USA:
Multi-Tech Systems Inc.
2205 Woodale Drive
Mounds View, MN 55112
(612) 785-3500/(800) 328-9717
FAX (612) 785-9874

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